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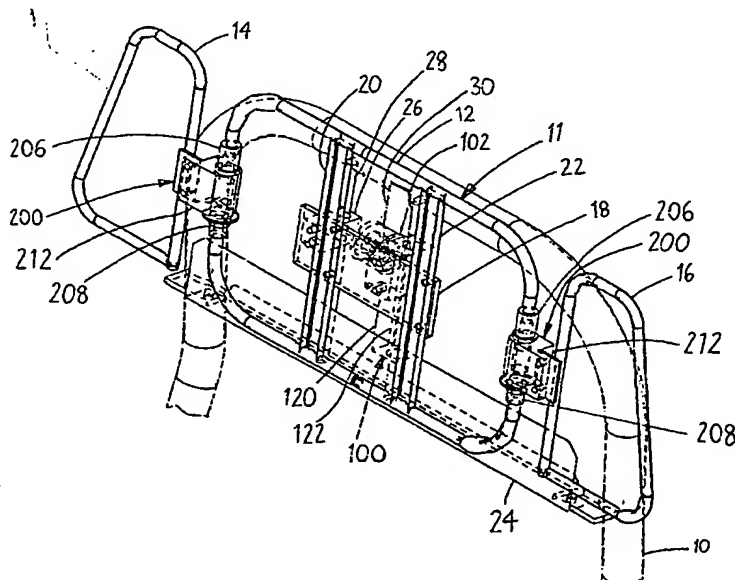
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(54) Title: COUPLING APPARATUS AND SEAT STRUCTURE



**(57) Abstract**

**Apparatus for coupling first and second members comprises means for connecting the first and second members such that the first is moveable relative to the second through a range of travel, clamping means (104; 202) for exerting a clamping force to resist movement of the first member relative to the second, said clamping means being capable of acting throughout said range, and means (106; 210) for at least partially releasing the clamping means on movement of said first member relative to said second member. Various different embodiments of coupling apparatus are disclosed. Use of the above apparatus in coupling two portions of a seat structure is also disclosed.**

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COUPLING APPARATUS AND SEAT STRUCTURE

The present invention relates to apparatus for coupling first and second members, and more particularly to apparatus for coupling two portions of a seat structure, such as a headrest and seat body or an ear of a headrest and the main body of the headrest. It also relates to a seat structure, particularly one for use in aircraft, but also such as could be used in cars or other vehicles.

15 Seat structures are known in which the headrest is adjustable by sliding into and out of the seat body. Such adjustability is important to provide proper support for users of different heights. In such structures, a pair of prongs projects from the headrest. The prongs are located  
20 in holes in the top of the seat body. The prongs have a series of indentations which cooperate with detents associated with the holes, to define a series of vertically spaced locations for the headrest. The headrest can be moved manually between these locations by overcoming the  
25 action of the detents.

Such structures suffer from a number of disadvantages. Firstly, there is only a limited number of locations at which the headrest can be set. Secondly, because of the  
30 action of the detent mechanism the headrest is noisy to operate. Thirdly, to provide the necessary support, the detent mechanism needs to be fairly stiff. This renders the headrest difficult to move. Fourthly, and finally, because of the stiffness of the detent mechanism, it is  
35 prone to wear.

Seat structures are also known in which the two headrest ears are pivotable relative to the main body of the headrest. Such ears can provide adjustable support for the  
40 user's head, especially if he is attempting to sleep. Pivoting is restrained by a simple frictional coupling, such that the user can rest his head against one of the

ears without it moving.

The problem with this arrangement is that the frictional coupling wears quickly, so that an ear rapidly becomes  
5 incapable of taking the weight of a user's head resting on it. Furthermore, in order to achieve the requisite frictional resistance, the components of the frictional coupling need to be machined to high tolerances. This is time-consuming and expensive.

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A pivotal coupling between a footrest and a seat body is also known, in which the footrest can be clamped against pivoting, the clamping force being releasable manually via a control lever.

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The clamping force is provided by a so-called "spring-wrap" device. In broad terms, a spring-wrap device usually comprises a resilient clamping member adapted to exert a clamping force on a clamped member when in its relaxed  
20 state and adapted to be at least partially released from its relaxed state so that the clamping force is reduced or eliminated.

In more detail, a spring-wrap device usually consists of a  
25 resilient annular spring "wrapped" around a shaft, the diameter of the spring in its relaxed state being less than that of the shaft. In the known coupling, the spring is a circular leaf spring. In this known coupling, movement of the control lever acts to separate or pull together the two  
30 ends of the spring, thereby releasing or imposing the clamping force.

This coupling has the disadvantage that it is inconvenient and cumbersome to use, in that it requires manual operation  
35 via a lever. Also, the lever is prone to breakage or mechanical failure.

The present invention seeks to overcome the above problems.

According to the present invention, there is provided apparatus for coupling first and second members, comprising  
5 means for connecting the first and second members such that the first is moveable relative to the second through a range of travel, clamping means for exerting a clamping force to resist movement of the first member relative to the second, said clamping means being capable of acting  
10 throughout said range, and means for at least partially releasing the clamping means on movement of said first member relative to said second member.

This invention can afford several advantages. Firstly,  
15 manual operation via a lever is not required, since the present invention can provide effectively for automatic release of the clamping means. Hence the apparatus of the present invention can be highly robust. Secondly, in that the clamping means is capable of acting throughout the  
20 range of travel, the two members can be infinitely adjustable with respect to each other; furthermore, the clamping force can be arranged to be constant over the range of travel. Thirdly, because the invention can provide automatic release of the clamping means on relative  
25 movement of the members, operation of the apparatus can be virtually noiseless. Fourthly, again because of the automatic release of the clamping means, the apparatus does not need to be particularly stiff. Hence, fifthly, the apparatus need not be prone to wear; furthermore, it can be  
30 designed to be self-compensating if wear does occur because of the provision of separate clamping and release means. Sixthly, and finally, again because of the provision of separate clamping and release means rather than a simple frictional coupling, manufacturing tolerances need not be  
35 particularly high. This can avoid the need for precision machining of the components and the consequent effort and expense which this involves.

Preferably, the clamping means comprises a spring-wrap device. Preferably, the spring-wrap device comprises a helical spring, and the apparatus includes a cylindrical member around which the spring is mounted and upon which it is adapted to exert the clamping force. These features can afford a simple way of putting the invention into practice. In particular, a spring-wrap device can be relatively cheap and wear-free. It can be used to resist both sliding and rotational movement.

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Preferably, the apparatus includes a resilient member arranged such that the first member is moveable relative to the second member against the resilience of the resilient member without releasing the clamping means. Use of such a resilient member has been found to allow particularly smooth relative movement of the first and second members.

Preferably, the release means comprises a formation adapted to cooperate with the clamping means on movement of said first member relative to said second member. This can lead to a simple and practical design of coupling apparatus.

Preferably, the connecting, clamping and release means are arranged such that the resistance to movement of the first member relative to the second is adjustable. Thus the coupling apparatus can be adjusted to suit individual requirements.

Preferably, the connecting, clamping and release means are arranged to permit movement of the first member relative to the second in two opposing directions through said range of travel. This can allow for repeated adjustment of the two members. The two opposing directions may either be linear directions (for example, up and down), or else rotational directions (clockwise and anti-clockwise).

Preferably, the connecting, clamping and release means are

arranged to permit movement of the first member relative to the second member more easily in one direction than in the other. This feature, which is also provided independently, can be used to advantage in different ways, as is described  
5 later.

The first member may be slidable relative to the second member, in which case preferably the clamping means comprises a spring-wrap device and the apparatus includes  
10 a cylindrical member adapted to be clamped by the spring-wrap device and along which the spring-wrap device is slidable. The cylindrical member may suitably be right-circularly cylindrical.

15 Preferably, only one clamping means is provided to resist sliding of the first member relative to the second. This has been found to facilitate a smoother sliding action than is possible with conventional apparatus in which two separate detent mechanisms or the like are provided. Such  
20 conventional apparatus has a tendency to jam.

The first member may alternatively be rotatable relative to the second member, in which case preferably the clamping means comprises a spring-wrap device and the apparatus  
25 includes a member adapted to be clamped by the spring-wrap device and relative to which the spring-wrap device is rotatable.

In the preferred embodiment of rotary coupling apparatus,  
30 the spring-wrap device is releasable via two release formations, one such formation being adapted to be mounted for movement with one of the first and second members such that rotation of the first member relative to the second in one direction causes release of the spring-wrap device and  
35 rotation in the opposing direction causes the clamping force to be exerted, the other such release formation being adapted to cooperate with a formation on said one of the

first and second members on rotation of the formation in the opposing direction to release at least partially the clamping means when the clamping force exceeds a given level. The given level of clamping force may be adjustable  
5 to suit particular requirements.

Preferably, the first and second members are releasably attached to each other, for ease of maintenance and the like.

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The present invention extends to a seat structure including apparatus as aforesaid and said first and second members, the first and second members being relatively moveable parts of said structure. One of the parts may be a  
15 headrest member.

If one of the parts is the headrest member, then preferably the headrest member is slidable relative to the body of the seat structure such that throughout its travel it overlaps  
20 at least partially the seat body. This feature may be provided independently. This feature can afford a more ergonomic design of seat. Furthermore, since the headrest member always overlaps the body of the seat structure and hence can be supported by it, the headrest member need not  
25 be as strong as it would need to be if it were entirely unsupported by the seat structure.

Preferably, the clamping means and/or the release means are located in the body of the seat structure, separate from  
30 the headrest member. This can afford a particularly simple design of seat structure.

For ease of maintenance and the like, preferably, the headrest member is releasably attached to the body of the  
35 seat structure.

For the comfort of the user, preferably the headrest member



comprises at least one support plate for supporting the user's head. Also, by using one or more support plates (which can be produced using press tools) rather than a tubular construction for the headrest member, manufacturing  
5 can be simplified.

Preferred features of the invention are now described, by way of example only, with reference to the accompanying drawings, in which:-

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Figure 1 is a perspective view of a top portion of an aircraft seat structure according to the present invention;

Figure 2 is a front elevational view corresponding to the perspective view of Figure 1;

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Figure 3 is a corresponding side elevational view;

Figure 4 is a corresponding plan view;

Figure 5 is a cross-sectional view of a sliding coupling apparatus according to the present invention, the cross-section being taken along the line 'XX' shown in

20  

Figure 6b;

Figures 6a and 6b are front elevational views of the sliding coupling apparatus, with a guide plate being shown in place in Figure 6a and removed in Figure 6b;

25  

Figure 7 is a sketch, to an enlarged scale, of a spring-wrap device and release means forming part of the sliding coupling apparatus, the device and release means being shown while at rest;

30  

Figure 8 is a sketch corresponding to that of Figure 7 but with the device and release means being shown during motion;

Figure 9 is a plan view of a rotary coupling apparatus according to the present invention;

Figure 10 is a front elevational view corresponding to the plan view of Figure 9;

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Figure 11 is an exploded view of a sliding coupling apparatus according to an alternative embodiment of the present invention; and

Figure 12 is an exploded view of a headrest structure according to the alternative embodiment of the invention.

Referring first to Figures 1 to 4, the top portion of an aircraft seat structure is shown. The remainder of the structure is of conventional design. It will be understood that the structure would be upholstered before installation into an aircraft.

- 10 In broad terms, the seat structure as shown comprises a tubular seat frame 10 forming part of the main body of the seat structure, and a headrest structure 11 comprising a central headrest member 12 and two outer headrest members (or "ears") 14 and 16 pivotally coupled to respective sides of the central member 12. As shown in Figures 1 to 4, the three headrest members 12, 14 and 16 are largely of tubular construction. However, in an alternative embodiment, the central headrest member 12 is formed largely from a single roughly rectangular plate. This alternative embodiment may enhance the user's comfort, since the user is less likely to feel the plate through the headrest upholstery. The alternative embodiment is described later with reference to Figures 11 and 12.
- 25 The central headrest member 12 is slideably coupled to the seat frame 10 via a sliding coupling apparatus 100 described in more detail later. This is attached to a mounting block 18 itself attached to two cross bars 20 and 22 and thence attached to the central headrest member 12.
- 30 The sliding coupling apparatus 100 includes a ground steel rod 102, hardened against wear, along which the remainder of the apparatus is slidable. This rod is rigidly attached to the seat frame 10 and to a cross member 24 of generally "L"-shaped cross section, itself attached to the seat frame
- 35 10. A nylon bracket 26 attached to the mounting block 18 is slidable along a further rod 28, and serves to prevent pivoting of the central headrest member 12 about a vertical

(or near-vertical) axis with respect to the seat frame 10.

As will be apparent from Figures 1 to 4, the headrest structure 11 is slidable relative to the seat frame 10 up and down in a near-vertical plane. Rather than extending upwardly from the top of the seat frame 10, the headrest structure 11 is located in front of the frame and, even at its highest point of travel, still overlaps with the top of the frame. The headrest structure is located sufficiently forward of the seat frame that, once upholstered, its back is in light contact with the upholstery of the seat body.

Attached to the mounting block 18 is a Tensator (trade mark) spring 30, the free end of the spring being attached to the top of the seat frame 10. (A Tensator spring is designed to provide a substantially constant spring force whatever its extension.) The purpose of the Tensator spring is to bias the headrest structure 11 upwardly somewhat so that, when fully upholstered, its weight is roughly in equilibrium with the spring force. This facilitates height adjustment of the headrest by the user. In fact, it may be desirable to arrange that the fully upholstered headrest is somewhat upwardly biased, to resist downwards movement of the headrest if the aircraft suffers a hard landing.

Each outer headrest member 14, 16 is pivotally coupled to the central member 12 via a respective rotary coupling apparatus 200 described in more detail later. The coupling apparatus 200 is such that its respective outer headrest member 14, 16 is easier to move forwardly away from the seat body (to deploy it) than it is to move backwards (to stow it). Hence the user may deploy the member with relatively little force, but may rest his head on the member without it rotating backwards towards the seat body (unless sufficient force is applied).

Referring now to Figures 5 to 8, the sliding coupling apparatus 100 in general terms comprises a spring-wrap device 104 adapted to exert a clamping force on the hardened steel rod 102 (which rod is, as aforesaid, attached to the seat frame 10) and a means 106 for releasing the spring-wrap device 104 on sliding of the headrest structure 11 relative to the seat frame 10, the release means 106 being mounted for movement with the headrest structure 11.

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In more detail, the spring-wrap device 104 comprises a torsion coil spring 110, the two ends of which project radially outwards as release formations 112 and 114. The coil spring in its relaxed state has a diameter less than that of the rod 102 and hence, unless released by the release means 106, grips the rod firmly to prevent sliding.

The release means 106 includes a body 120 machined from a solid square cross-section block of metal so as to possess a central bore 122 receiving the rod 102 and coil spring 110, and a groove 124 opening into the bore 122. A guide plate 126 is attached to one face of the release means body 120 so to cover the groove 124. The guide plate 126 has a slot 128, shaped as shown in Figures 6a, 7 and 8, in which the two release formations 112 and 114 are engaged.

The coupling apparatus 100 also includes a pair of linear bearings 130, 132 mounted in the bore 122 of the release means 106 for movement with the body. The linear bearings 130 and 132 ensure that the headrest structure 11 slides smoothly relative to the seat frame 10. If it is desired to shorten the length of the body 120 (for instance, to increase the range of travel of the headrest structure 11 or to reduce its height), then the linear bearings may be omitted from the body and instead may be arranged to slide along the further rod 28. In both cases, the linear bearings are as far apart as possible to ensure a smooth

sliding action for the headrest structure 11.

The coil spring 110 is sandwiched between a pair of bushes 140, 142 (each bush being slotted to receive a respective  
5 release formation 112, 114), a pair of matched coil springs 144, 146, a pair of protective washers 148, 150 and finally the pair of linear bearings 130, 132. All of these components are contained within the body 120 so that they move generally in unison when the body (and hence the  
10 entire headrest structure 11) is moved. The bushes 140 and 142 serve to transfer the movement of the body to the coil spring 110 via the pair of coil springs 144, 146.

The operation of the sliding coupling apparatus 100 is now  
15 described with particular reference to Figures 7 and 8. When the headrest structure 11 is at rest (that is, it is not being moved relative to the seat frame 10), the spring-wrap device exerts a clamping force on the hardened steel rod 102 to resist movement of the structure. This state is  
20 shown in Figure 7, with the two release formations 112 and 114 being in line with the axis of the rod 102.

The structure 11 is moveable to a limited extent both up and down against the resilience of one or other of the coil  
25 springs 144 and 146 without releasing the clamping means. The structure may be thought of as floating freely about an equilibrium position. For this limited extent, the release formations 112 and 114 slide along the central portion of the slot 128 of the guide plate 126, parallel to the axis  
30 of the hardened rod 102.

However, as shown in Figure 8, when the headrest structure 11 is moved in one or other direction beyond this limited extent, one or other of the release formations 112, 114  
35 moves into one or other of the slanted end portions of the slot 128, rotating its respective bush 140, 142 in so doing. This movement of the release formation causes the

coil to unwind ("unwrap") slightly and the internal diameter of the coil spring 110 to increase slightly and partially release it from its clamping action on the rod 102. The structure 11 is thereby moveable relative to the  
5 seat frame 10 in either direction though its full range of travel.

It will be appreciated that if the user ceases to move the structure 11 the release formations 112 and 114 move back  
10 in line with the axis of the rod 102 and hence the clamping force is re-imposed by the spring-wrap device 104. In other words, release of the spring-wrap device 104 only occurs whilst the structure 11 is in motion.

15 The overall resistance to movement of the headrest structure 11 relative to the seat frame 10 is dependent on several factors, such as the torsional strength of the torsion coil spring 110, the compressional strength of the pair of coil springs 144, 146, the shape of the slot 128  
20 and the speed of movement of the structure. The resistance can be altered to suit specific requirements particularly easily by the use of guide plates with differently shaped slots. Indeed, resistance to movement may be rendered greater in one direction than another by the use of a slot  
25 whose end portions are slanted at different angles, or by coil springs 144, 146 of different strengths.

Referring now to Figures 9 and 10, the rotary coupling apparatus 200 in general terms comprises a spring-wrap  
30 device 202 adapted to exert a clamping force on a hardened steel rod 204 which is rigidly attached to the central headrest member 12 by means of a pair of collars 206, 208, and a means 210 for releasing the spring-wrap device 202 on rotation of the appropriate outer headrest member 14, 16  
35 relative to the central headrest member 12, the release means 210 being mounted for rotation with the outer headrest member 14, 16.

The appropriate outer member 14, 16 is coupled to the central member 12 via a bracket 212 fixed to the outer member 14, 16 and including top and bottom bearing portions 214 and 216. These bearing portions receive the rod 204 and hence permit the relative rotation of the outer headrest member 14, 16. A cover 218 covers the interior workings of the apparatus 200.

In more detail, the spring-wrap device 202 comprises a torsion coil spring 220, the first end 222 of which projects straight outwards from the spring and the second end 224 of which is cranked. These two ends act as release formations. The coil spring 220 in its relaxed state has a diameter less than that of the rod 204 and hence, unless released by the release means 210, grips the rod firmly to prevent rotation. The coil spring is sandwiched between two washers 226 and 227 and, outside of these, the bearing portions 214 and 216. A cylindrical housing 228 with a sector-shaped cross-section protects the coil spring 220.

The release means 210 includes a bolt 230 attaching the first (fixed) end 222 of the coil spring 220 to the bracket 212 so that this end moves with the bracket and hence the appropriate outer member 14, 16. The release means 210 also includes an adjustable grub screw 232 mounted in a portion 234 of the bracket 212 raised from the body of the bracket. When the outer member 14, 16 is at rest, the end of the grub screw 232 is close to, but not touching, the second (free) end 224 of the coil spring 220. Rotation of the outer headrest member 14, 16 relative to the central member 12 causes the end of the grub screw to rotate towards or away from the end 224. A guide (not shown) is also provided for the end 224 to prevent this end slipping off the end of the grub screw 232 when these two are in engagement.

The operation of the rotary coupling apparatus is now

described. Rotation of the appropriate outer headrest member 14, 16 away from the seat frame 10 (to deploy it) causes the first end 222 of the coil spring 220 to increase slightly the internal diameter of the coil spring and hence partially release it from its clamping action on the rod 204, so that the headrest member can be easily deployed to its desired position.

Conversely, slight rotation of the headrest member towards the seat frame 10 (to stow the member) causes the first end 222 of the coil spring 220 to decrease the internal diameter of the coil spring and hence exert a progressively stronger clamping force on the rod 204 to resist rotation of the headrest member. At a given (slight) rotation the clamping force reaches a given level. Further rotation of the headrest member towards the seat frame 10 causes the second end 224 of the coil spring 220 to cooperate with the end of the grub screw 232 to release the coil spring partially from its clamping action on the rod 204. Upon yet further rotation, the second end 224 remains in cooperation with the grub screw 232, and hence the resistance to this further rotation remains substantially constant over the range of travel of the outer headrest member 14, 16 towards the seat frame 10.

The clearance between the end of the grub screw 232 and the second end 224 of the coil spring 222 when the appropriate outer headrest member 14, 16 is at rest dictates the overall resistance afforded by the coupling apparatus 200 to rotation of the member towards the seat frame 10. This clearance is adjustable by screwing or unscrewing the grub screw 232, and would normally be set such that the resistance to rotation of the member towards the seat frame 10 is significantly greater than its resistance to rotation away from the frame. Hence, the member is easier to deploy than to stow. The clearance would normally be set such that the member can support the weight of a user's head



resting on it.

An alternative embodiment of seat structure is now described with reference to Figures 11 and 12, in which  
5 like components of the seat structure to those described previously are denoted by like reference numerals.

One of the main differences between this alternative embodiment and the previously described embodiment is that  
10 the central headrest member 12 is formed largely from a single roughly rectangular metal or (preferably) Nylon (trade mark) support plate 300 (see Figure 12). Equally, the outer headrest members 14 and 16 are formed largely from single Nylon (trade mark) support plates. The plate  
15 for headrest member 16 is denoted 301. Member 14 is not shown in Figure 12. This arrangement can enhance the user's comfort, since the user is less likely to feel the plate through the headrest upholstery than he is the tubular structure of the previously described embodiment.

20 In Figure 12 are shown squab assemblies for the central headrest member 12 and the outer headrest member 16; these are designated respectively 302 and 303. A similar squab assembly is provided for the outer headrest member 14. The  
25 various squab assemblies are bonded or otherwise fastened to their respective headrest members.

Another major difference is that the headrest structure 11 is releasably attached to the sliding coupling apparatus  
30 100 by means of two pairs of cooperating engagement formations, the male and female members of each pair being denoted respectively 304 and 306, and a latch device 310.

The male members 304 each comprise a location boss which is  
35 fastened to the mounting block 18 of the coupling apparatus 100 by a self-tapping screw 308; the female members 306 each take the form of a keyhole slot in the support plate

300 in the central headrest member 12. The male members of each pair are adapted to be inserted into the hole portion of the keyhole slots, and then to be slid along the slotted portion of these slots, so that the male and female members  
5 engage together.

The latch device 310 comprises on the sliding coupling apparatus 100 (see Figure 11) a catch 312 comprising a nutsert type nut riveted to the mounting block 18 and  
10 fastened in place by self-tapping screw 314, and on the headrest structure 11 (see Figure 12) a latch member 316 for engaging with the catch 312, a latch holder 318 fastened in place by a self-tapping screw 320, and a coil spring 322 for biasing the latch member into the latching  
15 position in which it engages the catch 312. The latch member is moveable to release the catch against the bias of the spring. The pairs of cooperating engagement formations and the latch device 310 enable easy removal of the headrest structure, for instance for cleaning or  
20 maintenance, but equally afford a secure means of releasably fastening the structure to the sliding coupling apparatus 100.

Other features of the sliding coupling apparatus 100 of the  
25 alternative embodiment of the present invention are now described with reference to Figure 11 where these differ markedly from those of the previously described embodiment.

Figure 11 shows the detail of the attachment of the  
30 Tensator (trade mark) spring 30 to the body 120 of the release means 106. The free end of the spring is attached to the top of the seat frame 10 by screw 330 and washer 332. The spring is held on a spool 334 which is in turn rotatably fastened to the body 120 by means of a half-  
35 threaded plain-shouldered screw 336 and a spool washer 338.

In the alternative embodiment smooth sliding of the

headrest structure 11 relative to the seat frame 10 is achieved in a somewhat different fashion. Two linear bearings 130 and 132 are again employed, but these are arranged to slide on a separate guide rod 340. The linear  
5 bearings are mounted in a separate bore 342 in the body 120. This arrangement can permit a particularly smooth sliding action. As with the previously described embodiment, the linear bearings are as far apart as possible to ensure a smooth sliding action for the headrest  
10 structure 11.

In consequence of the different arrangement of the linear bearings, the body 120 is shaped somewhat differently from the shape adopted in the previously described embodiment.

15 The linear bearings 130 and 132 are held in place by circlips 344 fitted into annular grooves in their respective bearings. The body 120 is covered at its ends by cover plates 346 fastened to it by self-tapping screws  
20 348, with the circlips sandwiched between the body and their respective cover plate so as to restrain the linear bearings against sliding. Self-tapping screws 348 are also employed to attach the guide plate 126 to the body.

25 Both the body 120 of the release means 106 and the bracket 26 have formations 350 and 352 shaped so as to fit into cooperating slot formations 354 and 356 in the mounting block 18, to prevent relative rotation thereof. Both of these members are fastened to the mounting block with self-  
30 tapping screws 358. Clearance for these screws is provided in the mounting plate 300 by way of slots 359.

In the exploded view shown in Figure 11, it will be understood that the rods 28, 102 and 340 are attached at  
35 their lower ends to the seat cross member 24 and at their upper ends to the seat frame 10 itself. The lower fastenings are achieved by means of screws 360 and washers

362.

Features of the rotary coupling apparatus 200 of the alternative embodiment of the present invention are now described with reference to Figure 12 where these differ markedly from those of the embodiment described with reference to Figures 9 and 10.

In this embodiment, the appropriate outer member 14, 16 is coupled to the central member 12 via the bracket 212 fixed to the outer member 14, 16 by means of four self-tapping screws 400, only one of which is shown in Figure 12 for simplicity. The bracket includes top and bottom bearing portions 214 and 216 in which are inserted top and bottom bearing bushes 402 and 404. These bearing bushes receive the hardened steel rod 204 on which is mounted the spring-wrap device. The rod is rigidly fastened to upper and lower pivot blocks 406 and 408 by means of grub screws 410, only one of which is shown for simplicity. The pivot blocks are in turn fastened to the support plate 300 of the central headrest member 12 by means of four self-tapping screws 412 (again only one of which is shown) screwed into nutsert type riveted nuts 413. Hence relative rotation of the respective outer headrest member 14, 16 and the central headrest member 12 is permitted by means of the relative rotation of the rod 204 and bracket 212.

The torsion coil spring 220 of the spring-wrap device 202 is fastened to the bracket 212 by means of screw 230 via ribbed washers 414, plain washers 416 and a thin nut 418.

The adjustable grub screw 232 is threadedly engaged with the bracket 212, and serves, as with the previously described embodiment, to adjust the stiffness of the rotary coupling.

Finally, a tension pin 420 is threadedly engaged with the

bracket 212, and protrudes therefrom. It is adapted to abut against the pivot block 408 to prevent excess rotation of the outer headrest member 16.

- 5 Whilst the alternative embodiment of rotary coupling apparatus has been described in detail with reference to the outer headrest member 16, it will be appreciated that a mirror image of the same coupling apparatus is employed for the outer member 14.

10

Each feature disclosed in the description, and (where appropriate) the claims and drawings may be provided independently or in any appropriate combination.

- 15 It will be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention.

CLAIMS

1. Apparatus for coupling first and second members, comprising means for connecting the first and second  
5 members such that the first is moveable relative to the second through a range of travel, clamping means for exerting a clamping force to resist movement of the first member relative to the second, said clamping means being capable of acting throughout said range, and means for at  
10 least partially releasing the clamping means on movement of said first member relative to said second member.
2. Apparatus according to Claim 1 wherein the clamping means comprises a spring-wrap device.  
15
3. Apparatus according to Claim 2 wherein the spring-wrap device comprises a helical spring, and the apparatus includes a cylindrical member around which the spring is mounted and upon which it is adapted to exert the clamping  
20 force.
4. Apparatus according to any of the preceding claims including a resilient member arranged such that the first member is moveable relative to the second member against  
25 the resilience of the resilient member without releasing the clamping means.
5. Apparatus according to any of the preceding claims wherein the release means comprises a formation adapted to  
30 cooperate with the clamping means on movement of said first member relative to said second member.
6. Apparatus according to any of the preceding claims wherein the connecting, clamping and release means are  
35 arranged such that the resistance to movement of the first member relative to the second is adjustable.

7. Apparatus according to any of the preceding claims wherein the connecting, clamping and release means are arranged to permit movement of the first member relative to the second in two opposing directions through said range of travel.
8. Apparatus according to Claim 7 wherein the connecting, clamping and release means are arranged to permit movement of the first member relative to the second member more easily in one direction than in the other.
9. Apparatus according to any of the preceding claims wherein the connecting means is adapted to connect the first member slidably relative to the second member.
10. Apparatus according to Claim 9 wherein the clamping means comprises a spring-wrap device and the apparatus includes a cylindrical member adapted to be clamped by the spring-wrap device and along which the spring-wrap device is slidable.
11. Apparatus according to Claim 9 or 10 wherein the clamping means is releasable via a release formation which is cooperable with a formation on the release means shaped such that sliding of the first member relative to the second moves the release formation to release the clamping means.
12. Apparatus according to any of Claims 9 to 11 wherein only one clamping means is provided to resist sliding of the first member relative to the second.
13. Apparatus according to any of the preceding claims wherein the connecting means is adapted to connect the first member rotatably relative to the second member.
14. Apparatus according to Claim 13 wherein the clamping

means comprises a spring-wrap device and the apparatus includes a member adapted to be clamped by the spring-wrap device and relative to which the spring-wrap device is rotatable.

5

15. Apparatus according to Claim 14 wherein the spring-wrap device is releasable via two release formations, one such formation being adapted to be mounted for movement with one of the first and second members such that rotation  
10 of the first member relative to the second in one direction causes release of the spring-wrap device and rotation in the opposing direction causes the clamping force to be exerted, the other such release formation being adapted to cooperate with a formation on said one of the first and  
15 second members on rotation of the formation in the opposing direction to release at least partially the clamping means when the clamping force exceeds a given level.

16. Apparatus according to Claim 15 wherein the given  
20 level of clamping force is adjustable.

17. Apparatus according to any of the preceding claims wherein the first and second members are releasably attached to each other.

25

18. A seat structure including apparatus according to any of the preceding claims and said first and second members, the first and second members being relatively moveable parts of said structure.

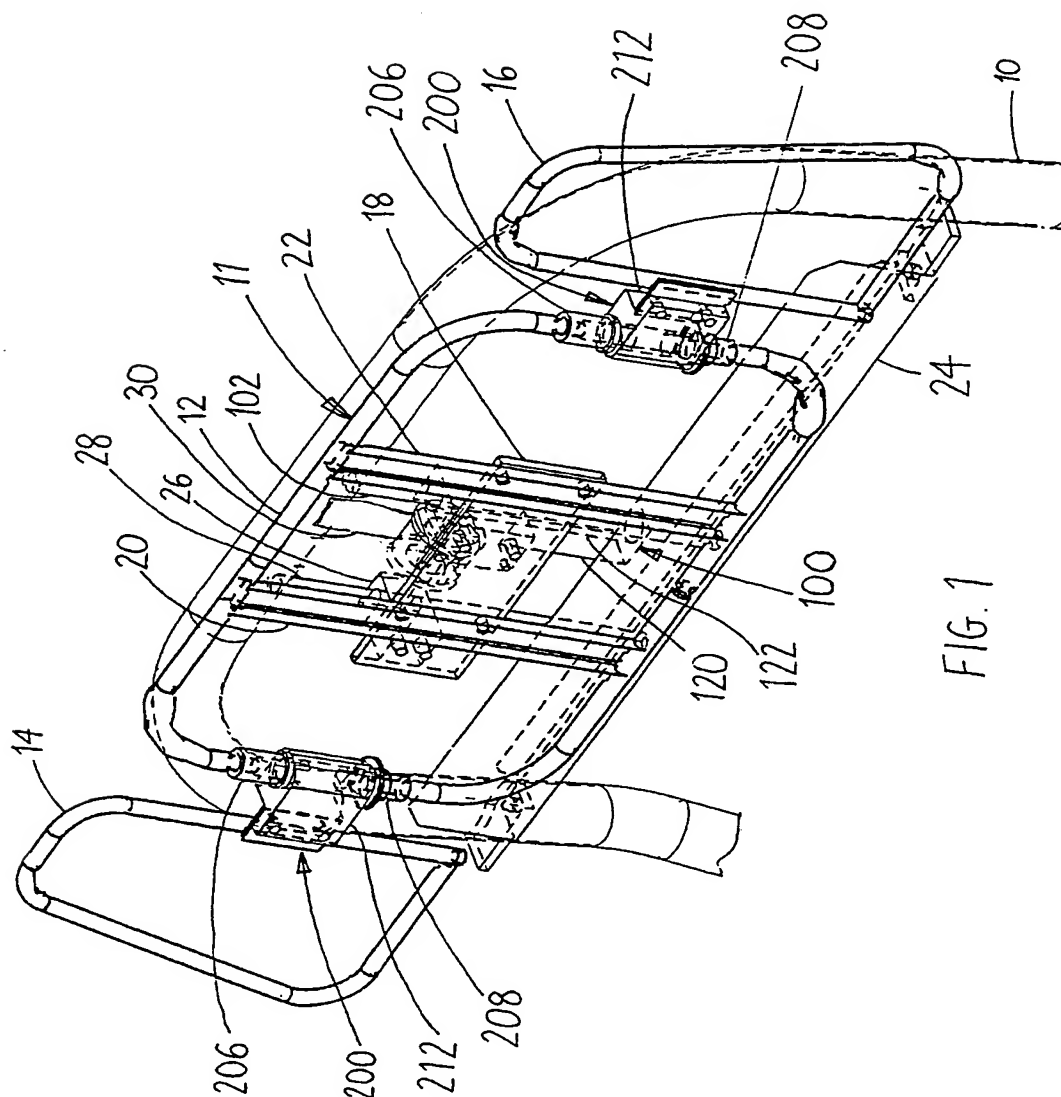
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19. A seat structure according to Claim 18 wherein one of the parts is a headrest member.

20. A seat structure according to Claim 19 wherein the  
35 headrest member is slidable relative to the body of the seat structure such that throughout its travel it overlaps at least partially the seat body.



21. A seat structure according to Claim 19 or 20 wherein the clamping means and/or the release means are located in the body of the seat structure, separate from the headrest member.
- 5
22. A seat structure according to Claim 19, 20 or 21 wherein the headrest member is releasably attached to the body of the seat structure.
- 10 23. A seat structure according to any of Claims 19 to 22 wherein the headrest member comprises at least one support plate for supporting the user's head.
- 15 24. A seat structure comprising a seat body, a member moveable relative to the seat body, and means for resisting movement of the member, the resistance being greater in a first direction than in a second direction.



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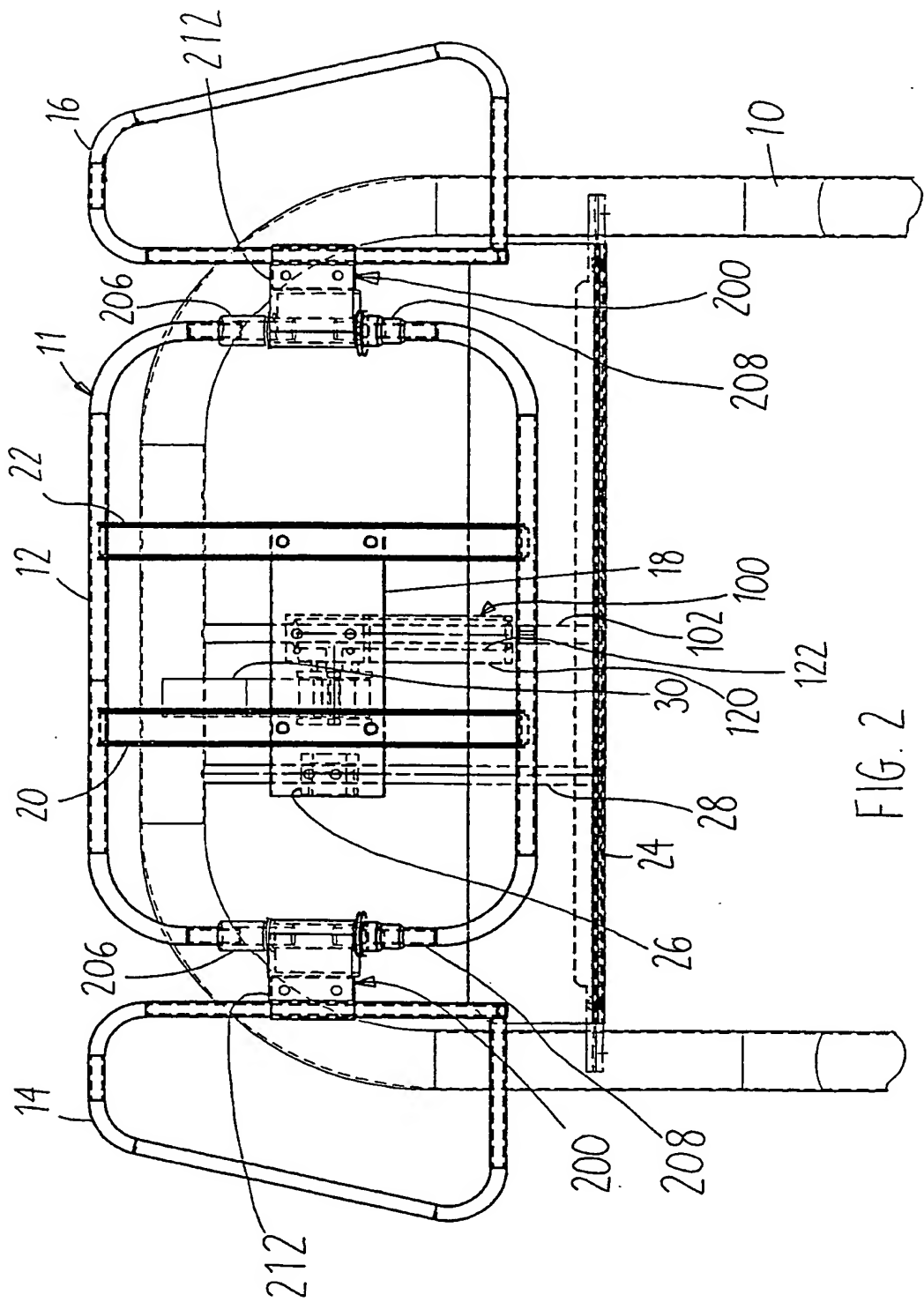
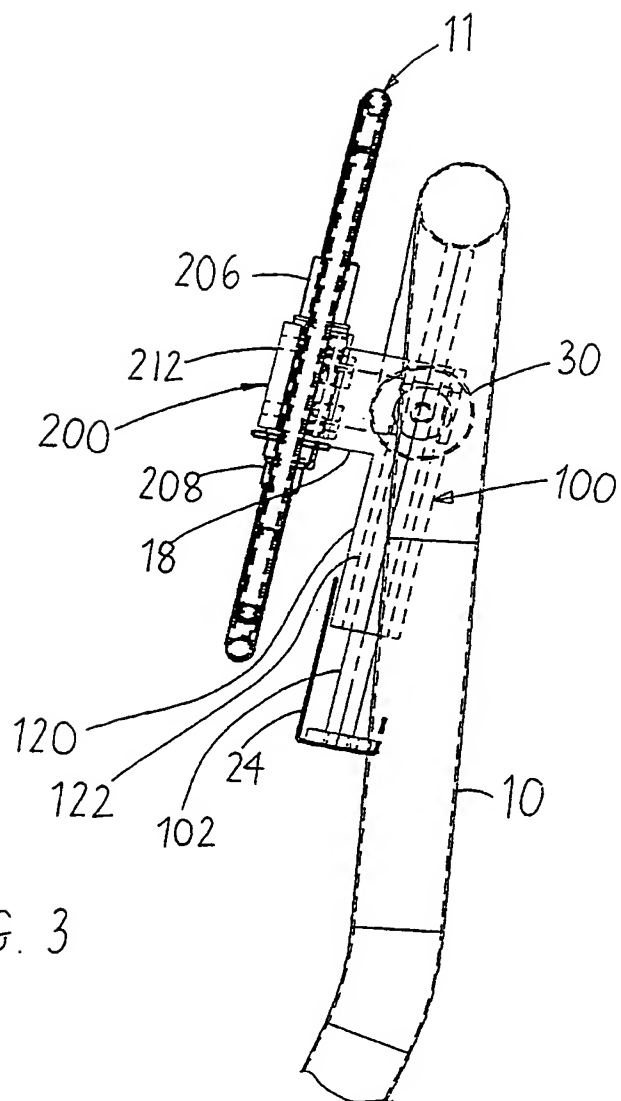


FIG. 2



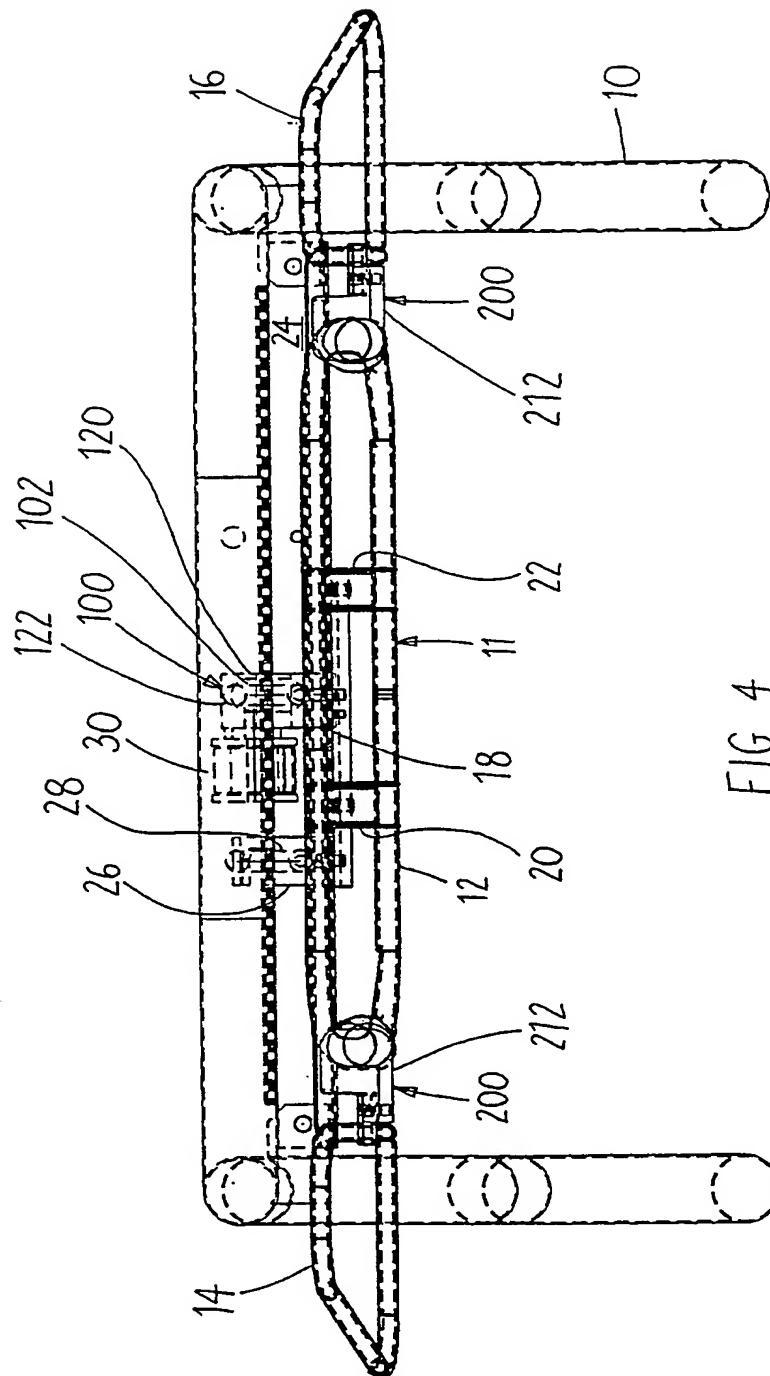
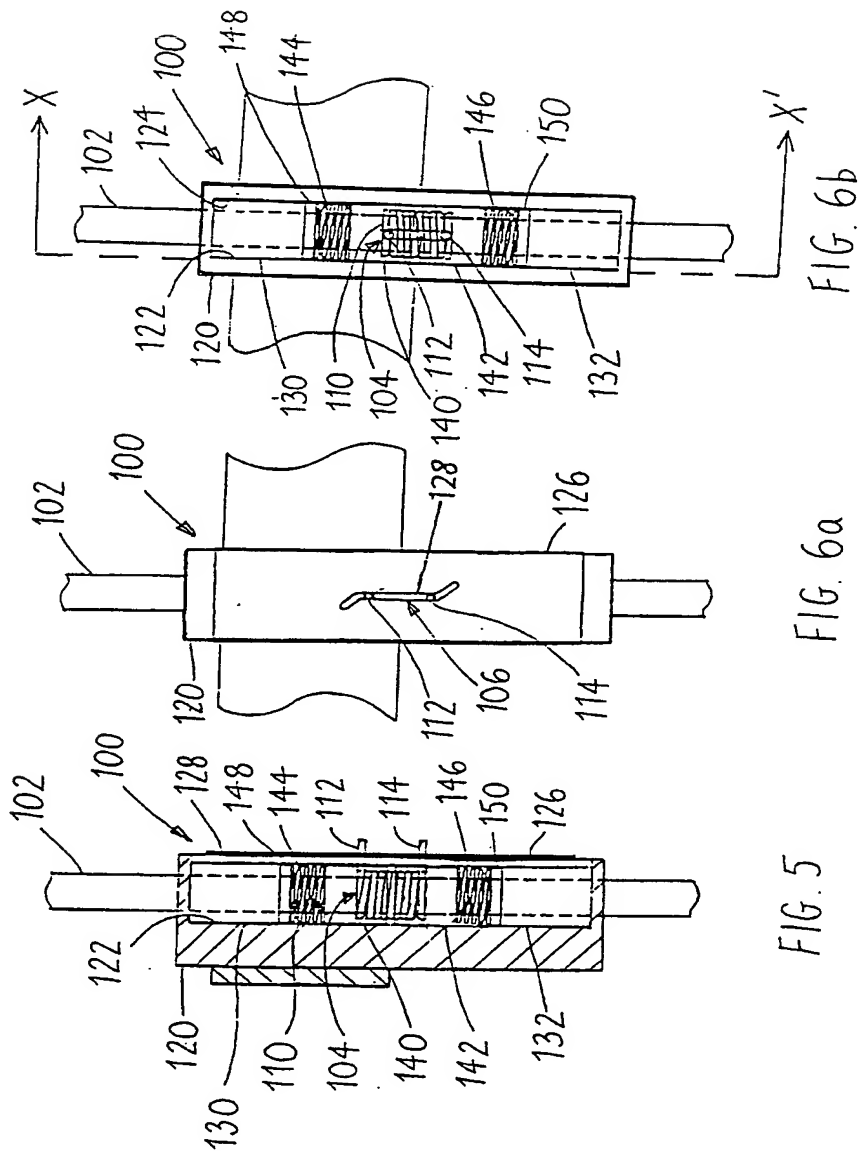
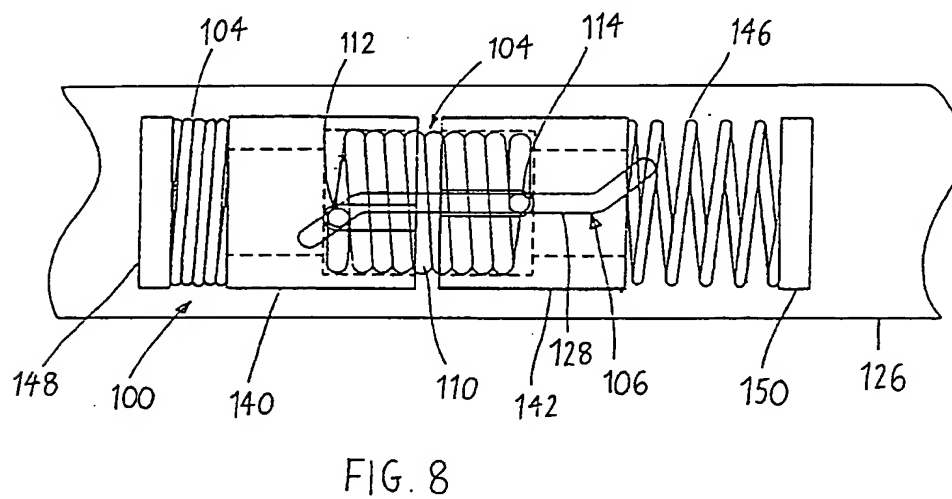
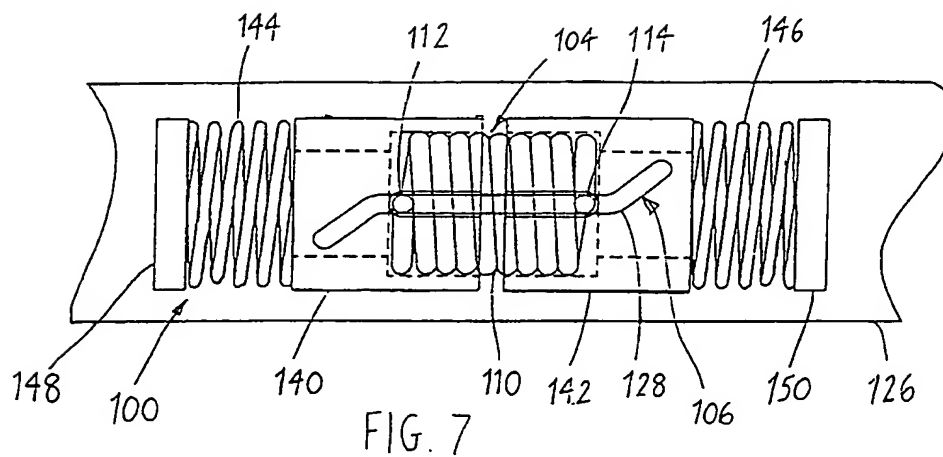
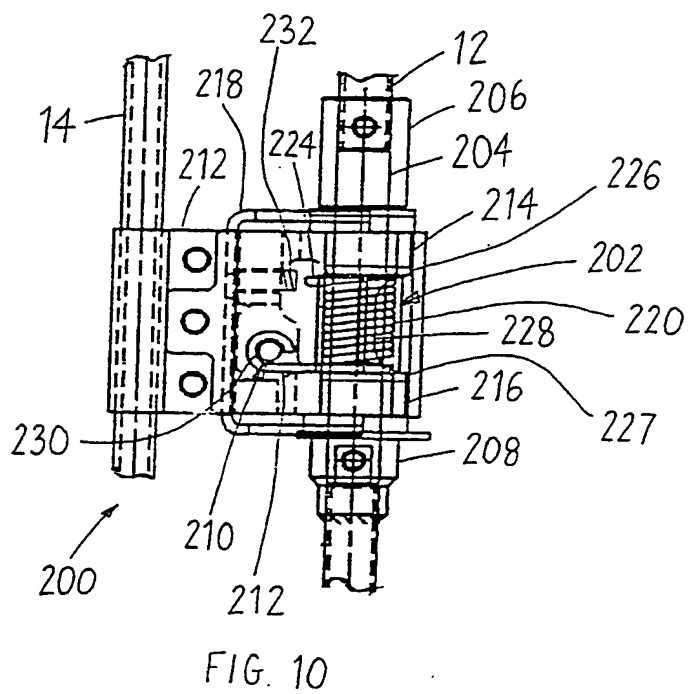
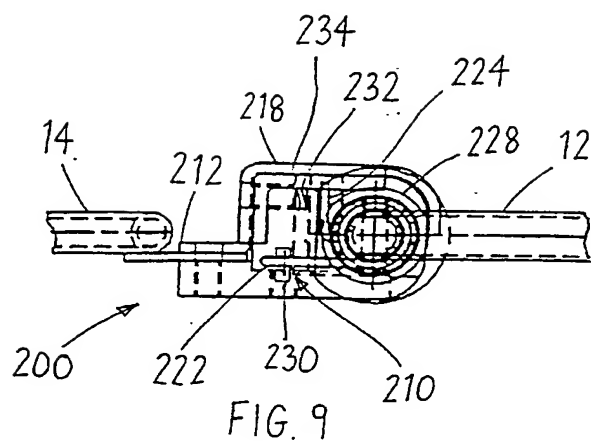


FIG. 4









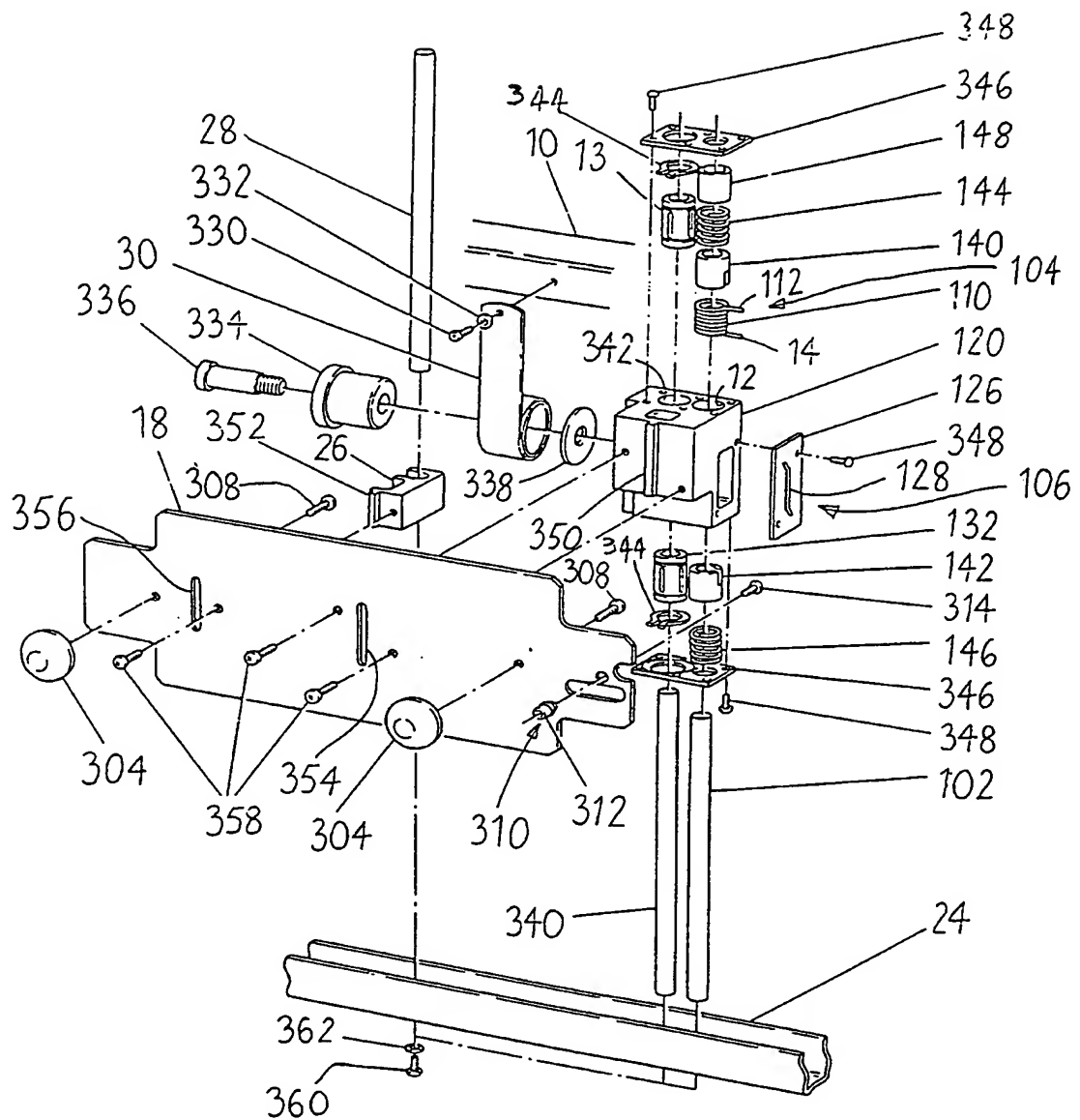


FIG. 11

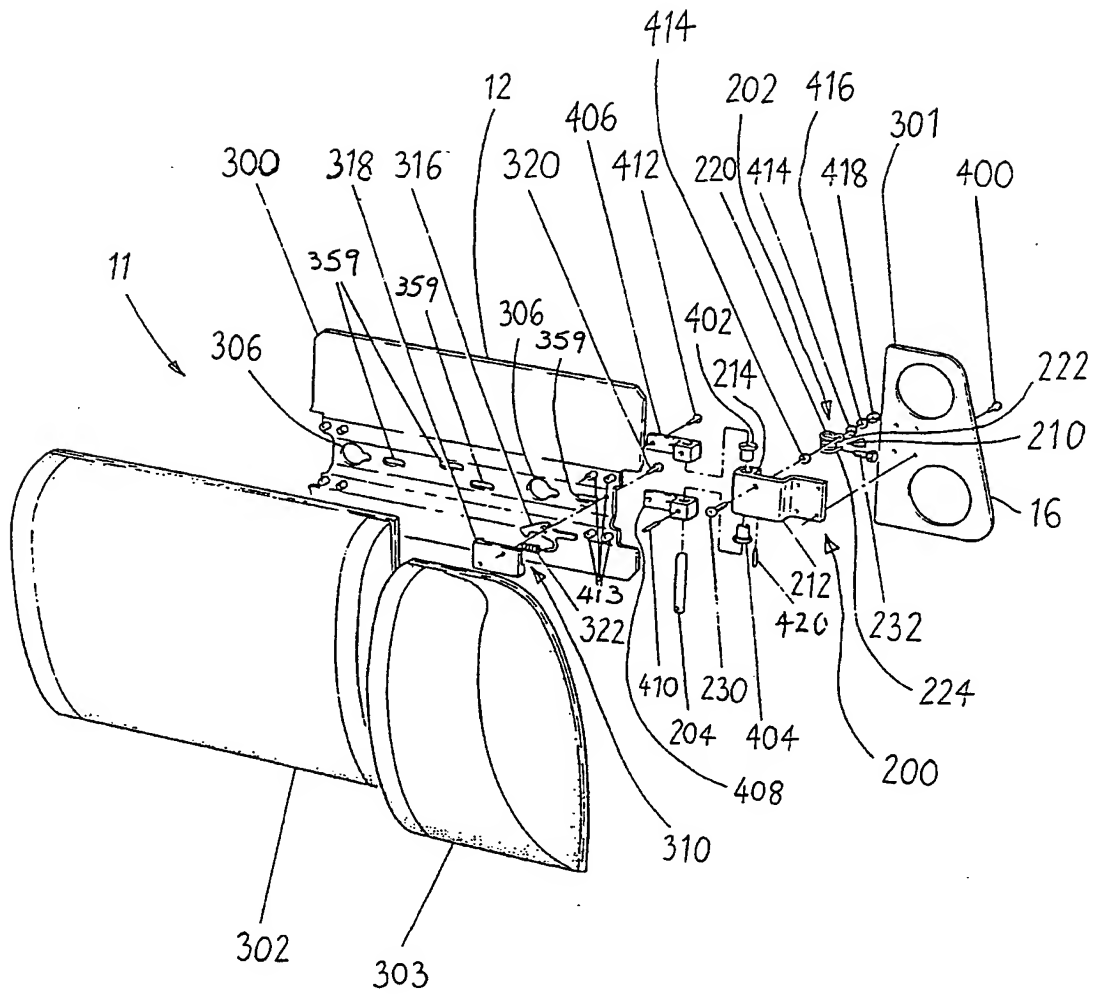


FIG. 12

# INTERNATIONAL SEARCH REPORT

Intern. Application No  
PCT/84/02139

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 B60N2/16 B60N2/44 B60N2/48

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,4 600 240 (SUMAN) 15 July 1986  see column 2, line 8 - column 5, line 3; figures 1-4,6,7 ---	1-3,5,7, 8,13,14, 17-19, 21-24
X	US,A,5 157 826 (PORTER) 27 October 1992  see the whole document --- -/--	1-3,5,7, 9,10,12, 17,18

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

28 December 1994

Date of mailing of the international search report

06.01.95

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## INTERNATIONAL SEARCH REPORT

Intern  
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 447 150 (KITAGAWA) 18 September 1991  see column 3, line 50 - column 4, line 28; figures 1-6	1,4,5,7, 8,13, 17-19, 21,22,24
A	----	20
X	FR,A,2 686 383 (BERTRAND FAURE) 23 July 1993  see page 1 - page 15; figures -----	1,4,5,7, 8,13, 17-19, 21,22,24

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page 2 of 2

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/04/02139

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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EP-A-0447150	18-09-91	AU-A- 7202491 JP-A- 5003820	12-09-91 14-01-93
FR-A-2686383	23-07-93	NONE	

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